

circle of 5° in diameter. A photograph taken in this way of a portion of the constellation of Orion, besides showing the three stars of the Belt and the Sword-Handle, gives an interesting picture of the nebula.

With reference to the question of the colours of stars it is interesting to note the faintness of α Orionis in the photographs. To the eye its brilliancy is almost as great as that of β , whilst in the photograph it is not more prominent than λ . The reason is to be found in the colour of α . It is a red star, and consequently makes but little impression on the photographic plate.

Again, in the constellation Cetus the three stars which are brightest to the eye are α , γ , and δ . α , which is the brightest of the three, has close to it a very faint companion, scarcely visible to the naked eye, its magnitude being given as 6.3, whilst that of α is 2.7. This is the appearance of this part of that constellation as seen by the eye. A photograph of this region was taken at Harvard with the result that the small star is seen in the photograph nearly as bright as α , it being only three-tenths of a magnitude less. The colour of these stars again explains this, α being of a reddish tint, whilst the small star is of a deep blue colour, and being so the rays which flow from it have a greater influence on the photographic plate. A comparison of the number of stars seen in the photograph of Orion with the number in the photometric catalogue, further illustrates this effect of colour. In that part of this constellation included between 5° north and 5° south declination, and 75° to 90° of right ascension, sixteen stars were common to photograph and catalogue; a like number, being either too small in magnitude or too red in colour, although catalogued, remain unrecorded on the photographic plate; whilst five others seen in the photograph are not given in the catalogue. A reduction has been made of the results given by the plates of different makers, with the view of ascertaining the value of the deviation. In two of such plates the average deviation was 0.21 of a magnitude, and in two measurements of the same plate it was found to be 0.07 of a magnitude.

It is obvious from this account of the work at Harvard that star photography is entering into a new phase, and one which will entirely replace the present system of eye observations, for the reason that, whilst the eye is so variable, photographic plates may now be obtained, doing their work with almost definite wave-lengths of light. The constant record of the plate, must in time therefore be preferred to observation by the variable eye. At the same time as photography advances, if it be considered necessary to obtain photographic star maps to record the observations of the average eye, there will be no difficulty in this being done.

NOTES

IN accordance with the provisions of the Statutes, the Council of the Royal Society met last Thursday to elect one from among themselves to fill the office of president until the annual election on November 30. The choice, as had been anticipated, fell upon Prof. Huxley. We believe that this *ad interim* election has given the greatest satisfaction to all the Fellows of the Society.

WE have received from the Johns Hopkins University, Baltimore, the circular giving the programme for the next academic year and a report on the work of the year that is past. Not only are a great number of subjects included in the programme of this University, but provision is made that the work in each section shall be thoroughly done, and we think the Trustees are to be entirely congratulated upon the progress that is being made. Among the scientific subjects we find physics, chemistry, geology, mineralogy, and biology in all its branches. With the other subjects which the programme sets forth we have here of course little to do, but we must add that we are glad to note under the heading "Philosophy" that the study of psychology is well pro-

vided for. Not only are there courses of lectures, but a limited number of the students are provided with seats in the physiological laboratory, where they may prosecute original research. It is so in all the scientific subjects. The work of the advanced student is arranged with a view of initiating him into the methods of original investigation, which, when he has finished his course of instruction, he is encouraged to carry on. Thus in the physical laboratory, which is under the direction of Prof. Rowland and Dr. Hastings, during the past year original investigations have been carried on in many parts of the subject; for instance, to name one or two, the concave grating has been used in an attempt to photograph the spectrum, and with it an endeavour has also been made to ascertain the wave-lengths of the lines. The unit of electrical resistance has also been investigated during the past year, and during the coming session an attempt will be made to establish an international unit for such resistance. We notice too, as a feature of the advanced course in physics conducted by Prof. Rowland, that besides the lectures and laboratory work there are weekly meetings for the discussion of the current literature of the subject. The courses in chemistry, which are under the sole control of Prof. Remsen, are likewise excellent. Besides the ordinary courses in general and analytical chemistry, the programme states that arrangements will soon be made by which the study of applied chemistry—for example, metallurgy, the chemistry of iron and steel, of dye stuffs, of soils and fertilisers—may be taken up by the students. Original research has been a prominent feature in this laboratory also, the results appearing in the *American Chemical Journal*. With regard to mineralogy and geology we notice that they are included in the courses on chemistry. The courses on biology are most excellent, general biology, embryology, osteology, and plant analysis being included in the first year's work. In the second year the student takes up mammalian anatomy, animal physiology and histology, and animal morphology. Then when the student desires to take up the study of marine animals, the University provides him with a laboratory by the sea itself. This laboratory was open last year from May 1 until September 29, and during that time the development of *Thalassema* was investigated, studies were made with regard to the origin of the oyster-shell, the parthenogenesis of the Echini, the development of Tubularia, and other subjects, which want of space alone prevents our mentioning. The results of these investigations are published in "Studies from the Biological Laboratory"; abstracts of two of these researches have also been printed in the *Proceedings of the Royal Society*, and Dr. E. B. Wilson's paper on the Development of Renilla will appear in the *Philosophical Transactions*. We might add much more to what we have said concerning the excellent character of the work done at this University, as we do not doubt that the other courses are as well provided for as the more purely scientific subjects to which alone we have referred. The Johns Hopkins University, in fact, although but a new institution, has been founded on a broad basis, giving to the student those opportunities for original work which it is so difficult to obtain elsewhere. We should much like to see such an account of original research done and to be done issuing each year from the laboratories of Oxford and Cambridge.

THE Berlin Academy of Sciences has elected Prof. Simon Newcomb (Washington) and Prof. B. Apthorp Gould (director of Cordova Observatory) as corresponding members.

IN our review of the life of Sir Edward Sabine, which appeared in our issue of last week (p. 219), we stated that he accompanied the expedition which under the command of Capt. James Ross was sent to make a magnetical survey of the Antarctic regions. This was an error, as although all the observations

were investigated and discussed by him he was not with the expedition, but had the observations forwarded to him at regular intervals.

THE whale which was found by a fisherman in Selsea Bay some six weeks since, and presented to the Brighton Aquarium, is a valuable addition to that establishment. Although undoubtedly belonging to the whale family, competent authorities have pronounced it to be a bottle-nosed dolphin, a creature rarely to be seen alive in an aquarium. It has been placed in a tank which holds 100,000 gallons of water, and is 110 feet in length, so that the animal, which is ten feet long, has some amount of freedom. It seems to be doing quite well, for not only has it not lost in bulk since its capture, but has even gained, weighing now more than eight hundredweight. It is very tame, taking its food from the attendant. At present it subsists upon mackerel, that being the food most easily obtained just now. Of these it takes five meals each day, and manages to eat some 400 of them during a week. The mackerel season is, however, almost over, and some other diet must be found for the animal, perhaps herrings. When first placed in the tank it retreated to one end. After a week's sojourn there, it sought the other end of the tank. Here it remains, swimming in circles. When swimming it keeps close to the surface of the water, moving through it with a graceful undulating movement, coming now and again to the surface, and taking in a fresh supply of air about every third or fourth time it thus rises. The animal is certainly an interesting acquisition to the Aquarium.

THE balloon of the Paris Observatory has been in working order for some weeks. Its capacity being only sixty cubic metres, it was found difficult to use it except in calm weather. The motions of the registering apparatus are an obstacle to correct readings. The experiments, conducted by Admiral Mouchez, are stated to be only preliminary to further aerostatical experiments. The subject is quite new, scientific ballooning being only in its infancy, and it is only by gradual investigation that the extent of the services it can render to science can be ascertained.

A CORRESPONDENT of the *North China Herald* describes a journey from Hankow on the Yangtze to Chungking in Szechuen, a distance of 720 geographical miles. After passing Ichang, the highest port on the great river opened to foreign trade, the first of the celebrated gorges is entered, and the mountainous country which extends up to and beyond Chungking begins. Through these ranges, which mostly run in a north and south direction, the Yangtze, here called the Ch'uan Ho, or river of Szechuen, forces its way. Leaving the wild, little-inhabited country of the gorges behind, the traveller, on reaching Wanhsien, 160 geographical miles above Ichang, emerges into a country of picturesque sandstone hills, at this season covered from base to summit with poppy gardens, with not a vacant spot except where perpendicular cliffs prevent all access. He emerges, too, among a people remarkable for their polished manners and especial politeness to Europeans. While Hupeh province was suffering from floods, the traveller found Eastern Szechuen, from Kweichow to Wanhsien, praying for rain. The drought here had extended over six months, the south gates of the cities were closed (as facing the *yang* or fire-element), and all slaughtering of animals was forbidden. From Wanhsien to Chungking, a distance of 200 miles, the aspect of the river remained the same—a succession of winding reaches, nearly all, owing to the peculiar sandstone formation, running at right angles to each other, and united by the customary rapid. Cliffs were frequent, and the sites of the towns and cities, built on steep projecting knolls, their walls and battlements crowning the precipices, are admirable. At length, two months from Shanghai, the traveller reached Chungking, the commercial metropolis of Szechuen, in which, by the Chefoo Convention, the English Government is

authorised to maintain a Resident, who watches the commercial prospects and movements of the great provinces of Szechuen and Yunnan.

THE *Paris Figaro* recently published a special supplement on Tonkin, and if the writer is to be credited, that country is one of the richest in the world. Its gold mines, he says, can rival those of California and Australia. The natives use that metal for exchange; the females of the Muongs of the Black River, on their way to and from market, gamble with thousands of francs worth of it, without caring whether they win or lose. The mines of Talan, near Yuen-kiang, on the Red River, were visited by the Commission of the Meikong, who found gold there in bars as well as dust. Still higher, near the source of the Red River, the precious metal is obtained in large quantities. Silver also is not rare, and copper is found everywhere, all the domestic utensils of the people being made of this metal. The tin mines are not worked for want of capital, although those worked near Mong-tze, in Yunnan, near the Red River, are the most valuable known to exist. Zinc, lead, iron, and bismuth are also known. The coal mines, however, are the most important of all. Tonkin produces also musk, tortoise-shell, mother-of-pearl, wax, silk, peacocks' feathers, as well as those of the blue pheasant, and other birds of brilliant plumage. "In short," concludes the *Figaro*, "it is a rich country, and worth the trouble of occupying it."

ANOTHER trial has been made in Paris of the electric tramcar in which Faure-Sellon-Volckmar accumulators were employed. The experiment was preceded by a lecture given by M. Philippart, tending to show the great economic superiority of electricity over the employment of horses. On this occasion the route chosen was not, as formerly, from the Place des Nations to La Muette and Trocadéro, but from Trocadéro to the Louvre and thence to the Place des Nations by the Bastille, an alteration made to show the capacity of the electric tramcar for ascending slopes on the common roads.

DR. OBACH has lately perfected his tangent galvanometer with a swinging coil. In the present form the coil is compound, being in reality one for measuring quantity and another for measuring electromotive force. The coil is movable on a horizontal axis, and therefore can be inclined at any angle. It has the advantage over a tangent galvanometer in having a suspended needle which can be rendered dead beat; the coils are also balanced so that the deflection corresponding to one volt with the high resistance coil is that which corresponds with one ampere with the low resistance coil. This instrument promises well for practical testing if made in a convenient portable form.

THE last number of the *Zeitschrift der Gesellschaft für Erdkunde* of Berlin contains a paper by Dr. F. Boas on the former distribution of the Eskimo in the Arctic-American archipelago. After referring to the discovery by Arctic travellers, in places where no human foot appears now to tread, of traces of habitations, graves, weapons, &c., he says that two theories have been broached to account for these remains. One is that the ice has encroached more and more on the sea, and driven away the people; the other that there has been a migration from the west across the archipelago. Dr. Boas rejects both of these explanations. He points out that, judging by the remains, the former inhabitants led precisely the same life as the Eskimo that we know to-day. He comes to the conclusion, after an examination of the various islands, of the distribution of traces of previous inhabitants and of the present tribes, that for numerous reasons we must abandon the theory that there was an earlier extension of inhabitants towards the north. He thinks that the remains found are those of the present tribes who have been driven from place to place by the necessity of obtaining subsistence, and refers to the

custom of several tribes to abandon huts in which death has taken place and to leave them standing. The hunting-grounds too would change from time to time according to the severity of the winter. A hard and fast boundary line cannot be laid down for inhabitants of the Arctic regions any more than for the flora. In favourable years plants are carried north and grow until a succession of severe winters again destroys them, and their remains might also lead, in the same way, to the incorrect conclusion that there had been a change in the climate of the region. Similarly with human settlements. The presence of traces of these latter in a given place show, not that the climate has become more severe, but that the place lies in that debatable land between districts favourable and unfavourable to the existence of man. Before any really satisfactory conclusion can be reached, however, he thinks we must have a thorough examination of the migration of the Eskimo; before it is possible to account for the presence of traces of the people in the far north on coasts where they do not now live, we must recollect how their wanderings depend on the physical conditions of life, on the nature of the ground, of the hunting, and the influence of the neighbouring tribes. But on all these points we lack material for a complete explanation of the facts. With respect to the comparatively great age claimed for some of these remains which have been brought by Arctic travellers to Europe, Dr. Boas suggests that all estimates as to the age of objects such as these coming from the Arctic regions must be taken with great care, owing to the different effects of the climate. He instances the remains of Parry's camp at Point Nias in Hecla Bay, which were found looking quite fresh in 1854, more than thirty years after Parry's expedition; while the cairn erected at the same time (1820) on Cape Providence was covered with lichen and moss, and looked quite ancient in 1854.

WE have received the Administration Report of the Meteorological Reporter to the Government of the North-West Provinces and Oudh for the years 1882-83. At the beginning of the present year the observatories reporting to the Allahabad Office were twenty in number, and great activity seems to have been displayed in all of them. The question of the construction of a first class observatory for these provinces has advanced during the present year, but only very slightly. It will in all probability be built at Allahabad. In addition to the ordinary observations, special observations of soil temperatures have been carried on at Allahabad and Jeypore. At Jeypore, where the observatory has practically become one of the first class, all records being made automatically, a sixth soil thermometer has been added to the five which the observatory already possesses to record the temperature at a depth of twenty feet. It is evident from the report that Mr. S. A. Hill, the meteorological reporter, is doing his level best with the means at his command. Unfortunately, however, the native observers still make mistakes, and some of the monthly means require a considerable amount of overhauling.

DR. HENRY MACAULAY, M.D., of Belfast, has recently made a suggestion which, if followed in tropical countries, will turn the tables on the sun with a vengeance. He suggests that Mouchot's sun-engine should be used to pump cold air into dwellings, factories, &c., pointing out that the temperature can in this way be reduced from 100° or more to 60°. He points out that not only will this reduce the temperature especially at night, thus rendering sleep possible, but fresh air will be guaranteed during the day, and the plague of flies and insects would be excluded. The weak point about this arrangement is that it requires ice. We think, however, that sooner or later in America, where the heat in summer is more distressing than in any other part of the world, and ice is everywhere, this arrangement, or one like it, is certain to be adopted.

THE last number of the *Proceedings of the Royal Society of Tasmania* contains several papers on the botany and zoology of Tasmania. In a presidential address the Governor, Sir J. Lefroy, remarks on the omission of any reference to the Botanic Gardens of Hobart Town by Prof. Thiselton Dyer, in a review of the botanical enterprise of the Empire, and demands more public support for these gardens. He notices also a fact which will be of some interest in England just now, viz. that of over ten thousand visitors to the Museum in six months more than half were Sunday visitors. Among the chief papers are:—Notes on a species of *Eucalyptus* (*E. hemastoma*), by Mr. Stephens; type species of Tasmanian shells, by Prof. Tate; the magnetic variation of Hobart, by Sir J. Lefroy; notes on *Leontopodium catipes*, by Baron von Müller, &c. With respect to the Sunday opening of the Museum, the Council of the Society report that it is open only between the hours of half-past two and five, "and this arrangement, as will be seen by the number availing themselves of the opportunity, may be pronounced to be no longer an experiment, and to be fully justified by the quiet and orderly demeanour of the visitors."

THE voyage round the world of the Swedish frigate *Vanadis*, which we recently announced, will be shared by the Duke of Gotland, King Oscar's youngest son. The journey, which will be of about eighteen months' duration, will chiefly be a scientific one, several eminent Swedish *savants* participating in the same. From the Straits of Magellan the ship will proceed to the Sandwich Islands, Japan, China, India, and thence home.

THE steamers *Obe* and *Nordenskjöld* left Tromsø for Novaya Zemlya on the 3rd inst. Norwegian fishermen report that the state of the ice in the Arctic Sea east of the North Cape is very favourable this spring.

M. PASTEUR has been appointed head of the Sanitary Commission formed in Paris in view of the dreaded visitation of cholera.

A FRENCH scientific periodical puts forward the idea of a joint occupation of Mecca by the several European powers for the purpose of stopping pilgrimages thither and thereby preventing the further dissemination of cholera through the crowding of people in so pestilential a city, especially when the Ramadan falls in summer.

WE are asked to say that possessors of the eighth edition of Prof. Babington's "Manual of British Botany" may, by application to Mr. Van Voorst, 1, Paternoster Row, obtain gratis two pages of additions and corrections which have been prepared by the author.

LOCUSTS are reported from the south of Russia, but the very energetic measures taken by the Governors for the destruction of the eggs and larvæ will, it is believed, arrest their ravages.

THE additions to the Zoological Society's Gardens during the past week include a Tennant's Squirrel (*Sciurus tennanti*) from Ceylon, presented by Mr. A. Ross; two Rufous Tinamous (*Rhynchotus rufescens*), three Spotted Tinamous (*Nothura maculosa*) from the Argentine Republic, presented by Mr. E. M. Longworthy; two Common Buzzards (*Buteo vulgaris*), British, presented by Mr. James S. Cookson; a Land Rail (*Crex pratensis*), British, presented by Mr. J. W. Merison; a Jackdaw (*Corvus monedula*), British, presented by Mr. J. Baldwin; two Cockateels (*Calopsitta nova-hollandiae*) from Australia, presented by Mrs. Day; three Angulated Tortoises (*Testudo angulata*), a Geometric Tortoise (*Testudo geometrica*), an Areolated Tortoise (*Testudo areolata*), a Robben Island Snake (*Coronella phocaenum*), a Laland's Ground Snake (*Typhlops lalandii*) from South Africa, presented by the Rev. G. H. R. Fisk, C.M.Z.S.; a Margined

Land Tortoise (*Testudo marginata*), South European, presented by Lord Arthur Russell, M.P.; an Indian Badger (*Arctonyx collaris*) from Assam, a Rough-billed Pelican (*Pelecanus trachyrhynchus*) from Mexico, purchased; two Red-crested Whistling Ducks (*Fuligula rufina*), a Variegated Sheldrake (*Tadorna variegata*), five Summer Ducks (*Aix sponsa*), five Chilian Pintails (*Dafila spinicauda*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN

THE CONSTANT OF ABERRATION.—M. Otto Struve presented to the Imperial Academy of Sciences of St. Petersburg, in February last, a memoir by M. Nyren, of the Observatory at Pulkowa, on the aberration of the fixed stars. He states it is the result of researches made by M. Nyren during many years, with the view to determine the value of the constant of aberration, with the highest degree of accuracy which the most perfect means of observation allow. The value $20''.445$, deduced by W. Struve, has been so far generally accepted by astronomers as the most exact, and has been employed in all astronomical calculations. This is the value given in his memoir upon the subject, but in 1852, by a new combination of his measures, the constant was altered to $20''.463$, and with respect to this value he remarked: "Elle me paraît le vrai résultat pour l'aberration, qui doit être tiré de mes observations du premier vertical." (Preface to "Recueil de Mémoires présentés à l'Académie des Sciences par les Astronomes de Poulkova," t. i.) Notwithstanding this statement, Struve's first value was retained in our ephemerides, &c.; we have a suspicion that his correction, as he appears to have considered it, was very generally overlooked. M. Nyren was charged with the execution of a new series of observations at Pulkowa, with the same instrument employed by the elder Struve, and every endeavour was made to free the new series from all objection that it was possible to bring against the earlier one. Further, M. Nyren discussed a long series of excellent observations made by M. Wagner with the great meridian telescope in the years 1861-72, on the three stars, Polaris, δ Ursæ Minoris, and γ Cephei. M. O. Struve remarks that with these two new determinations we now possess seven separate series of observations executed with the three great instruments of the Observatory of Pulkowa, and he gives the values of the constant of aberration resulting therefrom as follow:—

W. Struve, prime-vertical instrument	...	$20''.463 \pm 0''.017$
Schweizer, meridian telescope	...	$20''.498 \pm 0''.012$
Peters, vertical circle	...	$20''.507 \pm 0''.021$
Gylden, "	...	$20''.469 \pm 0''.026$
Wagner, meridian telescope	...	$20''.483 \pm 0''.012$
Nyren, vertical circle	...	$20''.495 \pm 0''.021$
Nyren, prime-vertical instrument	...	$20''.517 \pm 0''.014$

M. O. Struve considers that these values sufficiently prove that the constant of aberration is now known with a degree of accuracy which it will be difficult to surpass; it appears certain that the mean of the seven determinations deduced by M. Nyren, $20''.492$, will not be liable to an error of a hundredth of a second.

If this mean value for the constant of aberration is combined with the velocity of light determined by M. Cornu and Mr. Michelson, the solar parallax is found to be $8''.784$, which, M. Struve adds, only differs by a very few hundredths of a second from the most reliable determinations lately obtained by the geometrical process.

With regard to W. Struve's alteration of the constant of aberration assigned in his memoir, it may be remarked that his result depended upon observations made with the prime-vertical instrument upon seven stars, and the separate values accorded well. But, as he subsequently pointed out, this agreement of different determinations, obtained with the same instrument, only guaranteed the accuracy of the final result under the condition that there existed no common source of error. He examined all possible sources of constant error, and convinced himself that none existed which could exercise an appreciable influence. Nevertheless he said it must be admitted that there existed an agent which possibly might prejudice the exactness of his determination. Considering that the observations of the maximum of aberration fall at a time of year when the star passes the meridian near 6 p.m., while the observations of the minimum of the aberration take place at 6 a.m., it is seen that the first are made during a decreasing temperature and the last during an increasing

one. "The zenith-distance of the star being determined from the time between the two corresponding transits indicated by the clock, it follows, if the clock has a defect of compensation and if its effective rate during the interval differs from the mean daily rate obtained by observations of consecutive days, that the error produced acts in the same sense upon the results obtained by different stars." It is the same if between the two corresponding passages the azimuth of the axis of rotation changes. Fortunately these two perturbing causes only exercise a minute influence upon the zenith distances to be determined. Yet, as Struve asks: "Comment prouver que cette influence n'ait point altéré la valeur trouvée de l'aberration de quelques centièmes de seconde?" He considered he had direct proof that there was no azimuthal change, but with regard to change of clock rate, as already stated, he was induced to rediscuss his series of observations with the result above given.

ON THE FUNCTION OF THE SOUND-POST, AND ON THE PROPORTIONAL THICKNESS OF THE STRINGS OF THE VIOLIN¹

SIR JOHN HERSCHEL says: "It (the bridge) sets the wood of the upper face in a state of regular vibration, and this is communicated to the back through a peg set up in the middle of the fiddle and through its sides, called the 'soul' of the fiddle, or its sounding-post."²

Savart says: "L'âme a pour usage de transmettre au fond les vibrations de la table . . . son diamètre est déterminé par la qualité du son qu'on veut avoir; il est maigre quand elle est trop mince, et sourd quand elle est trop grosse."³

Daguin, in his "Traité de Physique," devotes a whole page to the discussion of the functions of the sound-post. The most important sentences are the following:—" . . . l'âme n'agit pas comme conducteur du son. . . Il nous semble que l'on doit expliquer l'effet de l'âme de la manière qui suit. L'âme, ou les pressions extérieures par lesquelles on la remplace, a pour effet de donner au pied du chevalet un point d'appui autour duquel il vibre en battant sur la table de son autre pied. Si l'un des pieds n'était appuyé sur un point fixe, il se releverait pendant que l'autre s'abaisserait, parce que les cordes n'agissent pas normalement à la table, puisque l'archet les ébranle très obliquement, ce qui entraîne le chevalet dans un mouvement transversal quand il n'a pas de point d'appui fixe. Lorsque l'archet est dirigé normalement aux tables, cet inconvénient n'existe plus, et l'âme n'est plus nécessaire."⁴

Helmholtz says: "The vibrating strings of the violin, in the first place, agitate the bridge over which they are stretched. This stands on two feet over the most mobile part of the belly between the two 'f' holes. One foot of the bridge rests upon a comparatively firm support, namely, the sound-post, which is a solid rod inserted between the two plates, back and belly, of the instrument. It is only the other leg which agitates the elastic wooden plates, and through them the included mass of air."⁵

The experiments⁶ which follow have been made for the purpose of ascertaining whether it be any part of the function of the sound-post to convey vibrations to the back, or whether this post acts solely as a prop supporting the belly, so that its elasticity is not injured by the pressure from the strings, and also, as Daguin states, affords the firm basis which he considers necessary for one foot of the bridge.

Mr. Hill and other practical men maintain that the quality of the wood of which the sound-post is made affects the tone of the violin, as undoubtedly do very minute differences of position. If the quality of the wood is important, we must admit that vibrations are conveyed by the post.

Whether or not the sound-post exercises the function of transmitting vibrations, it is obvious (1) that it performs the important duty of contributing to the support of the belly; (2) that the nodal arrangement of the belly and also that of the back are

¹ Paper read at the Royal Society, May 24, by William Huggins, D.C.L., LL.D., F.R.S.

² "Encyclopædia Metropolitana," Article "Sound," p. 804.

³ "Mémoire sur la Construction des Instruments à Cordes et à Archet," 8vo, Paris, 1819. Also Biot's "Report." *Ann. de Chimie*, tome 12, pp. 225-255.

⁴ "Traité de Physique, Acoustique," tome 1, p. 575.

⁵ "Sensations of Tone," translated by Ellis, p. 137. In the 4th German edition this passage remains unaltered.

⁶ I wish to express my indebtedness to Mr. A. J. Ellis for some suggestions in connection with these experiments.